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ward such as Jennings describes, for, according to Rhumbler, the ectoplasm in front is stretched between the *vis a tergo* and the friction against the substratum, is weakened and broken. The upper ectoplasm with a broken front edge can hardly be imagined to pull strongly upon the body behind it.

It is not expedient in this article to go more fully into the facts connected with this familiar phenomenon, which appears to be by no means as simple an action as Rhumbler supposes, when he compares it to the rolling of a rubber tire by hand or to the creeping of a drop of chloroform over a shellac-covered surface. Both of the papers cited, however, deserve the careful attention of every teacher of biology who touches upon the subject of *Amœba* and amœboid motion, although the conclusions of neither writer can be accepted without some modification.

JOHN H. GEROULD.

A CULTURE MEDIUM FOR THE ZYGOSPORES OF *MUCOR STOLONIFER*.

In the first edition of his 'Methods in Plant Histology' Professor Chamberlain speaks of the zygosporic phase of *Mucor* as being 'rarely seen' and requests information of anyone obtaining it. In the recent edition of the same work he refers to the researches of Dr. Blakeslee and then gives directions for making cultures for the zygosporic stage. The method described is rather haphazard and the tone in which it is stated indicates that the results would be doubtful.

During the past three months the present writer has obtained the zygospores so frequently that he now feels confident of being able to secure them at any time within a week. *With proper conditions of moisture and temperature, success is apparently dependent only on the nature of the substratum.* The substratum used is corn muffin bread, made, according to the baker, after the following formula:

Corn meal	16 pounds.
Flour	3 pounds.
Lard	3 pounds.
Salt	$\frac{1}{2}$ pound.

Eggs	48
Sweet milk	3 gallons.
Baking powder	18 ounces.

Half a dozen crumbs of this bread of the size of a thimble in as many tumblers, will yield on the average four or five cultures producing zygospores in large numbers in from five to seven days. The atmosphere should be kept saturated, the temperature about 70° F. and darkness is favorable though not necessary.

A series of experiments have been made and others are now under way to determine more exactly the conditions of zygosporic formation.

J. I. HAMAKER.

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THE EFFECT OF FERTILIZERS ON THE REACTION OF SOILS.¹

THE effect of fertilizers on the reaction of the soil has interested both the farmer and the scientist for many years, but little experimental work appears to have been done on the problem, however. It is frequently held by farmers that the continued use of fertilizers, particularly of acid phosphates, and also potash salts and ammonium sulphate results in the failure of the red clover crop, a result which is attributed to the acid residues left in the soil by the selective action of plants in removing the essential elements from the salts in which they are applied. While there can be no doubt that certain fertilizing materials, notably ammonium sulphate, will produce an injurious degree of acidity, even changing the reaction of an alkaline soil, the evidence with regard to other fertilizers is not so positive.

Only recently have methods giving definite results been devised by which the total acidity of a soil may be determined. It is possible to determine the acidity of soil within practical limits by the lime-water method,² and I have determined the present acidity of a known naturally acid soil which has received different fertilizing treatment, by this method.

Dr. Thorne, of the Ohio Experiment Sta-

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²*Jour. Amer. Chem. Soc.*, **26** (1904), 637.